

**PCT**WORLD INTELLECTUAL PROPE  
International Bu

INTERNATIONAL APPLICATION PUBLISHED UNDER

WO 9606966A1

(51) International Patent Classification <sup>6</sup> : <b>D04H 1/42</b>		A1	(11) International Publication Number: <b>WO 96/06966</b>
			(43) International Publication Date: 7 March 1996 (07.03.96)
(21) International Application Number: PCT/US95/09501		(81) Designated States: AM, AT, AU, BB, BG, BR, BY, CA, CH, CN, CZ, DE, DK, EE, ES, FI, GB, GE, HU, JP, KE, KG, KP, KR, KZ, LK, LR, LT, LU, LV, MD, MG, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, TJ, TT, UA, UZ, VN, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG), ARIPO patent (KE, MW, SD, SZ, UG).	
(22) International Filing Date: 28 July 1995 (28.07.95)			
(30) Priority Data: 08/298,502 30 August 1994 (30.08.94) US			
(71) Applicant: KIMBERLY-CLARK CORPORATION [US/US]; 401 North Lake Street, Neenah, WI 54956 (US).		Published <i>With international search report.</i>	
(72) Inventors: MC MANUS, Jeffrey, Lawrence; 2207 River Woods Way, Woodstock, GA 30188 (US). KOBYLIVKER, Peter, Michailovich; 920 Lerose Court, Marietta, GA 30068 (US). ALBERTELLI, Cindy, Jean; Apartment 7C, 7750 Roswell Road, Dunwoody, GA 30350 (US).			
(74) Agents: ROBINSON, James, B. et al.; Kimberly-Clark Corporation, 401 North Lake Street, Neenah, WI 54956 (US).			
(54) Title: NONWOVEN FABRIC FROM BLENDS OF ISOTACTIC AND ATACTIC POLYOLEFINS			
(57) Abstract			
<p>There is provided a nonwoven fabric comprising a layer of a nonwoven web comprising filaments prepared from a thermoplastic polymer. The thermoplastic polymer is a blend of at least one isotactic polymer having an isotacticity of at least 85, up to 40 weight percent of at least one atactic polymer having an isotacticity of less than 20, and the blend may also have a fluorocarbon in an amount between about 0.1 and 3.0 weight percent. The fabric may be produced by the spunbonding and meltblowing processes and has good strength, barrier and softness.</p>			

**FOR THE PURPOSES OF INFORMATION ONLY**

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AT	Austria	GB	United Kingdom	MR	Mauritania
AU	Australia	GE	Georgia	MW	Malawi
BB	Barbados	GN	Guinea	NE	Niger
BE	Belgium	GR	Greece	NL	Netherlands
BF	Burkina Faso	HU	Hungary	NO	Norway
BG	Bulgaria	IE	Ireland	NZ	New Zealand
BJ	Benin	IT	Italy	PL	Poland
BR	Brazil	JP	Japan	PT	Portugal
BY	Belarus	KE	Kenya	RO	Romania
CA	Canada	KG	Kyrgyzstan	RU	Russian Federation
CF	Central African Republic	KP	Democratic People's Republic of Korea	SD	Sudan
CG	Congo	KR	Republic of Korea	SE	Sweden
CH	Switzerland	KZ	Kazakhstan	SI	Slovenia
CI	Côte d'Ivoire	LI	Liechtenstein	SK	Slovakia
CM	Cameroon	LK	Sri Lanka	SN	Senegal
CN	China	LU	Luxembourg	TD	Chad
CS	Czechoslovakia	LV	Latvia	TG	Togo
CZ	Czech Republic	MC	Monaco	TJ	Tajikistan
DE	Germany	MD	Republic of Moldova	TT	Trinidad and Tobago
DK	Denmark	MG	Madagascar	UA	Ukraine
ES	Spain	ML	Mali	US	United States of America
FI	Finland	MN	Mongolia	UZ	Uzbekistan
FR	France			VN	Viet Nam
GA	Gabon				

NONWOVEN FABRIC FROM BLENDS OF ISOTACTIC AND ATACTIC POLYOLEFINS  
BACKGROUND OF THE INVENTION

5

Nonwoven fabrics are used for a wide variety of applications from baby wipes and diapers to automobile covers. These diverse applications call for materials having diverse properties and attributes. Some applications, for example, call for nonwovens which are highly wettable, i.e. quickly allow liquids to pass through them, e.g. liners for diapers and feminine hygiene products, while others require a high degree of strength and repellency, e.g. outdoor fabrics and surgical fabrics. It is the latter class of products with which this invention is concerned, specifically, nonwoven materials which have superior strength yet which have a high degree of vapor breathability and resistance to liquid penetration.

Fabrics for surgical applications, for example as a surgical gown, must have good liquid barrier properties in order to protect medical personnel from contact with the bodily fluids of the patient yet must be breathable in order for the wearer's perspiration to pass through the fabric so as to remain comfortable. The fabric must also be strong enough to perform the desired function in the appropriate environment yet be soft and drapeable for the wearer's comfort and to avoid restricting the wearer's range of motion.

It is also important in many applications of nonwovens, for example as garments, for the finished product to be as lightweight as possible yet still perform its desired function. A lighter garment performing the same function as a heavier garment would be more comfortable for the wearer and probably less expensive to manufacture since less raw material would be necessary for its production.

A lighter weight, soft fabric having high liquid barrier properties, high vapor transmission and good strength would be of great utility in a diverse range of applications.

It is therefore an object of this invention to provide  
5 a soft nonwoven laminate having high liquid barrier properties, high vapor transmission and good strength.

#### SUMMARY

10 There is provided herein, in order to satisfy the objectives of the invention, a nonwoven fabric comprising a layer of a nonwoven web comprising filaments prepared from a thermoplastic polymer, wherein the thermoplastic polymer is a  
15 blend of at least one isotactic polymer and at least one atactic polymer. The isotactic polymer should have an isotacticity of at least 85 and the atactic polymer an isotacticity of less than 20. The blend may have up to 40 weight percent of atactic polymer. The blend may also have a  
20 fluorocarbon in an amount between about 0.1 and 3.0 weight percent. The fabric may be produced by the spunbonding and meltblowing processes, for example, though meltblowing is preferred.

#### DETAILED DESCRIPTION OF THE INVENTION

25

#### DEFINITIONS

As used herein the term "nonwoven fabric or web" means a web having a structure of individual fibers or threads which  
30 are interlaid, but not in a regular, identifiable manner as in a knitted fabric. Nonwoven fabrics or webs have been formed from many processes such as for example, meltblowing processes, spunbonding processes, and bonded carded web processes. The basis weight of nonwoven fabrics is usually expressed in ounces  
35 of material per square yard (osy) or grams per square meter (gsm) and the fiber diameters useful are usually expressed in

microns. (Note that to convert from osy to gsm, multiply osy by 33.91).

As used herein the term "microfibers" means small diameter fibers having an average diameter not greater than about 50 microns, for example, having an average diameter of from about 0.5 microns to about 50 microns, or more particularly, microfibers may desirably have an average diameter of from about 2 microns to about 40 microns.

As used herein the term "spunbonded fibers" refers to small diameter fibers which are formed by extruding molten thermoplastic material as filaments from a plurality of fine, usually circular capillaries of a spinnerette with the diameter of the extruded filaments then being rapidly reduced as by, for example, in U.S. Patent no. 4,340,563 to Appel et al., and U.S. Patent no. 3,692,618 to Dorschner et al., U.S. Patent no. 3,802,817 to Matsuki et al., U.S. Patent nos. 3,338,992 and 3,341,394 to Kinney, U.S. Patent nos. 3,502,763 and 3,909,009 to Levy, and U.S. Patent no. 3,542,615 to Dobo et al. Spunbond fibers are generally continuous and larger than 7 microns, more particularly, having an average diameter of greater than 10 microns.

As used herein the term "meltblown fibers" means fibers formed by extruding a molten thermoplastic material through a plurality of fine, usually circular, die capillaries as molten threads or filaments into converging high velocity, usually heated gas (e.g. air) streams which attenuate the filaments of molten thermoplastic material to reduce their diameter, which may be to microfiber diameter. Thereafter, the meltblown fibers are carried by the high velocity gas stream and are deposited on a collecting surface to form a web of randomly disbursed meltblown fibers. Meltblowing is well known in the art and is described, for example, in U.S. Patent no. 3,849,241 to Buntin, U.S. Patent no. 4,307,143 to Meitner et al., and U.S. Patent 4,707,398 to Wisneski et al. Meltblown fibers are microfibers which may be discontinuous or continuous and generally smaller than 10 microns in diameter.

As used herein the term "polymer" generally includes but is not limited to, homopolymers, copolymers, such as for example, block, graft, random and alternating copolymers, terpolymers, etc. and blends and modifications of any of the foregoing. Furthermore, unless otherwise specifically limited, the term "polymer" shall include all possible geometrical configuration of the material. These configurations include, but are not limited to isotactic, syndiotactic and random symmetries.

As used herein the term "bicomponent fibers" refers to fibers which have been formed from at least two polymers extruded from separate extruders but spun together to form one fiber. The configuration of such a bicomponent fiber may be, for example, a sheath/core arrangement wherein one polymer is surrounded by another or may be a side by side arrangement or an "islands-in-the-sea" arrangement. Bicomponent fibers are taught in U.S. Patent 5,108,820 to Kaneko et al., U.S. Patent 5,336,552 to Strack et al., and European Patent 0586924. The polymers may be present in ratios of 75/25, 50/50, 25/75 or any other desired ratios.

As used herein the term "biconstituent fibers" refers to fibers which have been formed from at least two polymers extruded from the same extruder as a blend. Biconstituent fibers are sometimes referred to as multiconstituent fibers. Fibers of this general type are discussed in, for example, U.S. Patent 5,108,827 to Gessner.

As used herein the term "blend" means a mixture of two or more polymers while the term "alloy" means a sub-class of blends wherein the components are immiscible but have been compatibilized. "Miscibility" and "immiscibility" are defined as blends having negative and positive values, respectively, for the free energy of mixing. Further, "compatibilization" is defined as the process of modifying the interfacial properties of an immiscible polymer blend in order to make an alloy, usually through the use of a compatibilizer or additional substance which encourages blending of the polymers.

As used herein, the term "bonding window" means the range of temperature of the calender rolls used to bond the nonwoven fabric together, over which such bonding is successful. For polypropylene, this bonding window is typically from about 270°F to about 310°F (132°C to 154°C). Below about 270°F the polypropylene is not hot enough to melt and bond and above about 310°F the polypropylene will melt excessively and can stick to the calender rolls. Polyethylene has an even narrower bonding window.

As used herein, the term "machine direction" or MD means the length of a fabric as it is produced. The term "cross machine direction" or CD means the width of fabric, i.e. a direction generally perpendicular to the MD.

As used herein, the terms "necking" or "neck stretching" interchangeably refer to a method of elongating a nonwoven fabric, generally in the machine direction, to reduce its width in a controlled manner to a desired amount. The controlled stretching may take place under cool, room temperature or greater temperatures and is limited to an increase in overall dimension in the direction being stretched up to the elongation required to break the fabric, which in many cases is about 1.2 to 1.4 times. When relaxed, the web retracts toward its original dimensions. Such a process is disclosed, for example, in U.S. Patent no. 4,443,513 to Meitner and Notheis and another in U.S. Patent no. 4,965,122 to Morman.

As used herein the term "neck softening" means neck stretching carried out without the addition of heat, i.e. at ambient temperature, to the material as it is stretched in the machine direction. In neck stretching or softening, a fabric is referred to, for example, as being stretched by 20%. This means it is stretched in the machine direction until its width is 80% of its original unstretched width.

As used herein, the term "neckable material" means any material which can be necked.

As used herein, the term "necked material" refers to any material which has been constricted in at least one

dimension by processes such as, for example, drawing or gathering.

As used herein the term "recover" refers to a contraction of a stretched material upon termination of a biasing force following stretching of the material by application of the biasing force. For example, if a material having a relaxed, unbiased length of one (1) inch was elongated 50 percent by stretching to a length of one and one half (1.5) inches the material would have been elongated 50 percent and would have a stretched length that is 150 percent of its relaxed length. If this exemplary stretched material contracted, that is recovered to a length of one and one tenth (1.1) inches after release of the biasing and stretching force, the material would have recovered 80 percent (0.4 inch) of its elongation.

As used herein, the term "garment" means any type of apparel which may be worn. This includes industrial work wear and coveralls, undergarments, pants, shirts, jackets, gloves, socks, and the like.

As used herein, the term "medical product" means surgical gowns and drapes, face masks, head coverings, shoe coverings wound dressings, bandages, sterilization wraps and the like.

As used herein, the term "personal care product" means wipers, diapers, training pants, absorbent underpants, adult incontinence products, and feminine hygiene products and the like.

As used herein, the term "outdoor fabric" means a fabric which is primarily, though not exclusively, used outdoors. The applications for which this fabric may be used include car covers, boat covers, airplane covers, camper/trailer fabric, furniture covers, awnings, canopies, tents, agricultural fabrics and outdoor apparel.



### TEST METHODS

The alcohol repellency test measures how much a drop of an isopropanol/water mixture wets a piece of horizontally positioned fabric in a five minute period. In this test, a droplet of the mixture, typically 70 percent isopropanol and 30 percent distilled water, is placed on a piece of fabric. After five minutes the droplet is examined to determine the degree of wet-out of the fabric. In practice, this is done by comparing the droplet to a series of pictures showing droplets at varying degrees of wet-out on fabric to arrive at a rating of from zero to five. A rating of zero would indicate complete wet-out of the test fabric and a rating of 5 would indicate essentially no wet-out of the fabric. While this test is somewhat subjective, it does serve to differentiate between fabrics with good alcohol repellency and fabrics with poor alcohol repellency.

The melt flow rate (MFR) is a measure of the viscosity of a polymers. The MFR is expressed as the weight of material which flows from a capillary of known dimensions under a specified load or shear rate for a measured period of time and is measured in grams/10 minutes at 230°C according to, for example, ASTM test 1238, condition E.

### DISCUSSION

The field of nonwoven fabrics is a diverse one encompassing absorbent products such as diapers, wipes and feminine hygiene products and barrier products such as surgical gowns and drapes, and bandages. For applications in the latter field, a soft nonwoven laminate has been developed by the inventors which has good liquid repellency, good breathability and good strength.

The fibers from which the fabric of this invention is made may be produced by the meltblowing or spunbonding processes which are well known in the art. These processes generally use an extruder to supply melted thermoplastic polymer to a spinnerette where the polymer is fiberized to yield fibers which may be staple length or longer. The fibers

are then drawn, usually pneumatically, and deposited on a moving foraminous mat or belt to form the nonwoven fabric. The fibers produced in the spunbond and meltblown processes are microfibers as defined above.

5           The fabric of this invention may be used in a multilayer laminate. An example of a multilayer laminate is an embodiment wherein some of the layers are spunbond and some meltblown such as a spunbond/meltblown/spunbond (SMS) laminate as disclosed in U.S. Patent no. 4,041,203 to Brock et al., U.S.  
10 Patent no. 5,169,706 to Collier, et al, and U.S. Patent no. 4,374,888 to Bornslaeger. Such a laminate may be made by sequentially depositing onto a moving forming belt first a spunbond fabric layer, then a meltblown fabric layer and last another spunbond layer and then bonding the laminate in a  
15 manner described below. Alternatively, one or more of the fabric layers may be made individually, collected in rolls, and combined in a separate bonding step. Such fabrics usually have a basis weight of from about 0.1 to 12 osy (6 to 400 gsm), or more particularly from about 0.75 to about 3 osy.

20           Nonwoven fabrics are generally bonded in some manner as they are produced in order to give them sufficient structural integrity to withstand the rigors of further processing into a finished product. Bonding can be accomplished in a number of ways such as hydroentanglement, needlepunch bonding, ultrasonic  
25 bonding, adhesive bonding and thermal bonding.

          Ultrasonic bonding is performed, for example, by passing the fabric between a sonic horn and anvil roll as illustrated in U.S. Patent 4,374,888 to Bornslaeger.

          Thermal bonding of a nonwoven fabric may be  
30 accomplished by passing the nonwoven fabric between the rolls of a calendering machine. At least one of the rollers of the calender is heated and at least one of the rollers, not necessarily the same one as the heated one, has a pattern which is imprinted upon the nonwoven fabric as it passes between the  
35 rollers. As the fabric passes between the rollers it is subjected to pressure as well as heat. The combination of heat and pressure applied in a particular pattern results in the

creation of fused bond areas in the nonwoven fabric where the bonds on the fabric correspond to the pattern of bond points on the calender roll.

5 Various patterns for calender rolls have been developed. One example is the Hansen-Pennings pattern with between about 10 to 25% bond area with about 100 to 500 bonds/square inch as taught in U.S. Patent 3,855,046 to Hansen and Pennings. Another common pattern is a diamond pattern with repeating and slightly offset diamonds.

10 The exact calender temperature and pressure for bonding the nonwoven web depend on thermoplastic(s) from which the web is made. Generally for polyolefins the preferred temperatures are between 150 and 350°F (66 and 177°C) and the pressure between 300 and 1000 pounds per lineal inch. More  
15 particularly, for polypropylene, the preferred temperatures are between 270 and 320°F (132 and 160°C) and the pressure between 400 and 800 pounds per lineal inch.

One measure of the crystallinity of a polymer is the percentage of isotactic polymer versus total polymer. This is  
20 referred to as the isotacticity or isotactic index and may be calculated from the nuclear magnetic resonance curve for a polymer. Another test, for xylene solubles, measures the amount of low molecular weight isotactic and medium molecular weight atactic species in the polymer.

25 The thermoplastic polymers which are used in the practice of this invention are a blend of atactic (amorphous) and isotactic polyolefins. Further, Each of these components may be a mixture of different atactic or isotactic polymers.

Isotactic polymers have been used in the art of  
30 nonwoven fabrics and are known. An example of such a polymer is a polypropylene sold by the Exxon Chemical Company of Baytown, Texas under the trade designations PD-3746G and which is about 96% isotactic. Other suitable isotactic polymers are those available from the Shell Chemical Company of Houston,  
35 Texas under the trade designation Unipol® polymers. Shell's Unipol 1208 polypropylene, for example, has the a melt flow rate (MFR) of about 38, xylene solubles of about 6% and is

about 97% isotactic. Other manufactures such as the Himont Chemical Company of Wilmington, Delaware and the Dow Chemical Company of Midland, Michigan also produce suitable isotactic polyolefins. It is preferred that the isotactic polymer phase  
5 of this invention have an isotacticity of at least 85 percent.

The melt flow rate of a polymer may be raised through the addition of peroxide. Peroxide addition to a polymer for meltblowing applications is taught in U.S. Patent 5,213,881 to Timmons et al. In Timmons, up to about 3000 ppm of peroxide is  
10 added to a polymer which has been polymerized with a Ziegler-Natta catalyst. One such polymer is in the form of reactor granules and has a molecular weight distribution of 4.0 to 4.5 Mw/Mn and a melt flow rate of about 400 gms/10 min at 230°C prior to modification. Such a polymer is modified by the  
15 peroxide to have a molecular weight distribution in the range of about 2.2 to 3.5 Mw/Mn and a melt flow rate of about 800 to 5000 gms/10 min at 230°C. For example, the Exxon PD-3746G may be modified from an initial melt flow rate of 800 to a melt flow rate of about 2000 through the addition of peroxide.  
20 Other examples are given in Timmons. High melt flow polymers, i.e., those with melt flow rates above 1000, are preferred in the practice of this invention.

Atactic or amorphous polyolefins (APO) are produced for use as adhesives and sealants by a number of manufacturers.  
25 These materials are also sometimes also referred to as amorphous polyalphaolefins (APAO). Such polymers have an isotacticity of under 20 percent. The inventors are unaware of any prior applications of amorphous polyolefins to the art of nonwoven fabric manufacture.

30 The Eastman Chemical Company of Kingsport, Tennessee produces a series of amorphous polyolefins under the trade designation Eastoflex® APO. Eastoflex® APO is available as amorphous polypropylene homopolymer (APP), or amorphous polypropylene-polyethylene copolymer (APE) under a number of  
35 different numerical designations, e.g. P1010 and P1023 (APP), and E1010, E1060 and E1200 (APE). These numerical designations are based on the viscosity of the polymer at 190°C. For

example, P1010 has a viscosity of 1000 cP, P1023 has a viscosity of 2250 cP, E1060 has a viscosity of 6000 cP.

Amorphous polyolefins are also available from the Rexene Corp. of Odessa, Texas and are described at length in an article in the November 1992 issue of Adhesives Age. The Rexene amorphous polyolefins are designated Rextac® polyalphaolefins or RT APAO, for example RT 2535 has a viscosity of 3500 mPa.sec, RT 2585 has a viscosity of 8500 mPa.sec. Rexene produces amorphous polyolefins based on ethylene, propylene and 1-butene.

A third source of amorphous polypropylene of which the inventors are aware is the Findley Adhesive Company of Milwaukee, Wisconsin. A suitable Findley polypropylene is available under the trade designation H-9188 and is a mixture of 50 weight percent atactic polypropylene and 50 weight percent of Exxon's PD-3746G, without peroxide.

The suitable Eastman, Rexene and Findley polymers have an isotacticity of under 20 percent.

The fibers of this invention may have isotactic and amorphous polymer phases present in amounts from 99 weight percent isotactic and 1 weight percent amorphous, to 60 weight percent isotactic and 40 weight percent amorphous. Further, depending on the characteristics desired in the nonwoven fabric, either or both of the isotactic and atactic phases may be mixtures of a number of isotactic or atactic polymers respectively. Since the polymers of this invention are compatible, no additional compatibilizer is needed.

The fibers in the nonwoven fabric of this invention may contain a fluorocarbon chemical to impart low surface tension liquid repellency which may be any of those taught in U.S. patent 5,178,931, column 7, line 40 to column 8, line 60. One such material is called Zonyl® FTS and is available from E. I. DuPont de Nemours, Inc. of Wilmington, Delaware. A particularly well suited additive is FX-1801, formerly called L-10307, which is available from the 3M Company of St. Paul, Minnesota. This material is identified as Additive M in the

above cited patent and as having a melting point of about 130 to 138°C.

The fluorocarbon chemical may be added to the fibers in an amount of about 0.1 to about 3.0 weight percent or more particularly between about 0.25 and 1.0 weight percent. As noted in the cited patent, the fluorocarbon chemical is an internal additive, as differentiated from a topically applied additive, and preferentially migrates to the surface of the fibers as they are formed.

In order to be effective, it is believed that an internal additive should preferentially migrate or bloom to the surface of the fiber. This is believed to occur just as the fiber is formed and before it has cooled excessively. The determining factor in the movement of internal additives to the surface of a thermoplastic polymer fiber seems to be the rate of crystallization of the polymer which is brought on by cooling. The inventors believe, though they do not wish their invention to be limited by this belief, that crystallized or solid polymer blocks or otherwise impedes the movement of the additive through the polymer matrix since the additive cannot pass through the solid phase to the surface. By providing an amorphous, non-crystalline phase to the fiber, the inventors believe that a migration pathway is provided to the additive. The results of the movement of additives to the surface via the amorphous migration pathway created in the fibers of this invention are surprisingly superior in-process properties at lower concentrations of such additives.

The fabric of this invention may also contain fire retardants for increased resistance to fire, pigments to give each layer the same or distinct colors, and/or chemicals such as hindered amines to provide enhanced ultraviolet light resistance. Fire retardants and pigments for spunbond and meltblown thermoplastic polymers are known in the art and may be internal additives. A pigment, if used, is generally present in an amount less than 5 weight percent of the layer.

The fabric of this invention may also have topical treatments applied to it for more specialized functions. Such topical treatments and their methods of application are known in the art and include, for example, anti-static treatments and the like, applied by spraying, dipping, etc. An example of such a topical treatment is the application of Zelec® antistat (available from E.I. duPont, Wilmington, Delaware).

The fabric of this invention may also be neck stretched as taught in the above cited patents. Neck stretching or softening serve to soften the fabric yet do not deleteriously affect sheet properties to an unacceptable degree.

The blend of isotactic and atactic polymers in order to produce the fabric of this invention may be made by any method known in the art such as extrusion mixing where the polymers are fed into the extruder, melted and extruded as a blend. The polymers may also be mixed by pelletizing each of them, mixing them in a large container, and remelting them. Since the polymers are miscible, no undue problems are expected in the blending of the polymers.

Since a lighter weight fabric having the same properties as a heavier fabric is generally the most desired, the properties of the fabric of this invention were compared on the basis of weight as well as on the basis of barrier and strength.

The above mentioned characteristics of the fabric of this invention are illustrated by the examples below. In all of the tests, the spinnerette hole size was 0.37 mm with a polymer throughput of 0.5 grams/hole/minute (ghm), all fibers were spun at a melt temperature of 450°F (232°C), the air gap in all cases was 90 thousands of an inch and in a recessed configuration of 0.148 inches. The Exxon PD-3746G which was used was of the high melt flow type, i.e., having been treated with peroxide as mentioned above, except for that used to make the Findley H-9188 which contained no peroxide.

35

CONTROL 1

5 A fabric having a basis weight of 0.6 osy (20.4 gsm) was produced by the meltblowing process from polypropylene available from the Exxon Chemical Company and known as PD-3746G. The primary air pressure was 5.3 psig and primary air temperature was 533°F. The fabric was tested for alcohol repellency according to the above described test and the rating is given in Table 1.

10

CONTROL 2

15 A fabric having a basis weight of 0.5 osy (17 gsm) was produced by the meltblowing process from polypropylene available from the Exxon Chemical Company and known as PD-3746G. The meltblown layer contained FX-1801 fluorocarbon in an amount of about 1 weight percent. The primary air pressure was 3.2 psig and primary air temperature was 565°F. The fabric was tested for alcohol repellency according to the above described test and the rating is given in Table 1.

20

CONTROL 3

25 A fabric having a basis weight of 0.5 osy (17 gsm) was produced by the meltblowing process from polypropylene available from the Exxon Chemical Company and known as PD-3746G. The meltblown layer contained Dupont's Zonyl® FTS fluorocarbon in an amount of about 1 weight percent. The primary air pressure was 4 psig and primary air temperature was 550°F. The fabric was tested for alcohol repellency according to the above described test and the rating is given in Table 1.

30



EXAMPLE 1

5 A fabric having a basis weight of 0.6 osy (20.4 gsm) was produced by the meltblowing process from a blend of 80 weight percent polypropylene designated PD-3746G from Exxon Chemical and 20 weight percent of Findley Adhesive Company's H-9188. The primary air pressure was 5.1 psig and the primary air temperature was 533°F. The fabric was tested for alcohol repellency according to the above described test and the rating is given in Table 2.

EXAMPLE 2

15 A fabric having a basis weight of 0.6 osy (20.4 gsm) was produced by the meltblowing process from a blend of 79 weight percent polypropylene designated PD-3746G from Exxon Chemical, 20 weight percent of Findley Adhesive Company's H-9188, and FX-1801 fluorocarbon in an amount of about 1 weight percent. The primary air pressure was 4.9 psig and the primary air temperature was 531°F. The fabric was tested for alcohol repellency according to the above described test and the rating is given in Table 2.

EXAMPLE 3

25 A fabric having a basis weight of 0.5 osy (17 gsm) was produced by the meltblowing process from a blend of 79 weight percent polypropylene designated PD-3746G from Exxon Chemical, 20 weight percent of Findley Adhesive Company's H-9188 and Dupont Zonyl® FTS fluorocarbon in an amount of about 1 weight percent. The primary air pressure was 9.0 psig and the primary air temperature was 436°F. The fabric was tested for alcohol repellency according to the above described test and the rating is given in Table 2.

35

EXAMPLE 4

A fabric having a basis weight of 0.5 osy (17 gsm) was produced by the meltblowing process from a blend of 69 weight percent polypropylene designated PD-3746G from Exxon Chemical, 30 weight percent of Findley Adhesive Company's H-9188, and Dupont Zonyl® FTS fluorocarbon in an amount of about 1 weight percent. The primary air pressure was 9.0 psig and the primary air temperature was 436°F. The fabric was tested for alcohol repellency according to the above described test and the rating is given in Table 2.

TABLE 1

## ALCOHOL REPELLENCY TEST DATA

Control number	1	2	3
70 % isopropanol	0	0	0
80 % isopropanol	0	0	0
90 % isopropanol	0	0	0

TABLE 2

## ALCOHOL REPELLENCY TEST DATA

5

Example number	1	2	3	4
70 % isopropanol	0	5	4	5
80 % isopropanol	0	4,5	1,2	3,4
90 % isopropanol	0	3	0	0,1

10

Thus it has been shown that a fabric made in accordance with this invention has good alcohol repellency. The fibers of the fabric are further of a lower diameter which should provide improved softness. Keeping the barrier properties of this novel fabric about equivalent with current laminates would allow the production of a thinner, lighter weight material with accompanying reduction in raw material, production, and disposal costs, etc. and an increase in comfort for the wearer.

15

I claim:

1. A nonwoven fabric comprising a layer of a nonwoven web comprising filaments prepared from a thermoplastic polymer, wherein said thermoplastic polymer is a blend of an isotactic polymer phase and an atactic polymer phase.
2. The nonwoven fabric of claim 1 further comprising a fluorocarbon in an amount between about 0.1 and 3.0 weight percent.
3. The nonwoven fabric of claim 2 wherein said atactic polymer phase is a mixture of at least two atactic polymers.
4. The nonwoven fabric of claim 2 wherein said isotactic polymer phase is a mixture of at least two isotactic polymers.
5. The nonwoven fabric of claim 2 wherein said isotactic phase has an isotacticity of at least 85 percent and a melt flow rate of at least 1000.
6. The nonwoven fabric of claim 2 wherein said blend has from about 1 to about 40 weight percent atactic polymer phase.
7. The nonwoven fabric of claim 2 which is produced by a process selected from the group consisting of spunbonding and meltblowing.
8. The fabric of claim 7 wherein said process is meltblowing.
9. The nonwoven fabric of claim 8 wherein said fabric is placed between two layer of spunbond fabric and bonded together to form a laminate by a method selected from the group consisting of thermal bonding, ultrasonic bonding, hydroentanglement, needlepunch bonding and adhesive bonding.

10. The nonwoven fabric of claim 9 wherein said web further comprises a topically applied antistatic treatment.
11. The nonwoven fabric of claim 9 which has been neck softened.
12. The fabric of claim 9 which is present in a product selected from the group consisting of medical products, personal care products and outdoor fabrics.
13. The fabric of claim 12 wherein said product is a personal care product and said personal care product is a diaper.
14. The fabric of claim 12 wherein said product is a personal care product and said personal care product is a feminine hygiene product.
15. The fabric of claim 12 wherein said product is a medical product and said medical product is a surgical gown.
16. The fabric of claim 12 wherein said product is a medical product and said medical product is a face mask.
17. The fabric of claim 12 wherein said product is a personal care product and said personal care product is a wiper.
18. A nonwoven fabric comprising a layer of a nonwoven web comprising filaments prepared from a thermoplastic polymer, wherein said thermoplastic polymer is a blend of at least one isotactic polymer having an isotacticity of at least 85, up to 40 weight percent of at least one atactic polymer having an isotacticity of less than 20, and a fluorocarbon in an amount between about 0.1 and 3.0 weight percent, and which is produced by a process selected from the group consisting of spunbonding and meltblowing.

# INTERNATIONAL SEARCH REPORT

International Application No.

PCT/US 95/09501

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 6 D04H1/42

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 D04H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP,A,0 394 954 (JAMES RIVER CORP) 31 October 1990 see page 3, line 17 - page 4, line 50; examples 6,7 see page 16, line 47 - page 17, line 29 ---	1,7-10, 12-17
A	EP,A,0 273 582 (MINNESOTA MINING & MFG) 6 July 1988 see page 6, line 3 - page 9, line 52 ---	1,10
A	EP,A,0 300 689 (BP CHEM INT LTD) 25 January 1989 see page 3, line 39 - page 5, line 56 ---	1,10
P,A	EP,A,0 619 393 (HERCULES INC) 12 October 1994 see page 3, line 2 - line 36; example 1 -----	2



Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

### \* Special categories of cited documents:

- \*A\* document defining the general state of the art which is not considered to be of particular relevance
- \*E\* earlier document but published on or after the international filing date
- \*L\* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- \*O\* document referring to an oral disclosure, use, exhibition or other means
- \*P\* document published prior to the international filing date but later than the priority date claimed

- \*T\* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- \*X\* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- \*Y\* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- \* & \* document member of the same patent family

Date of the actual completion of the international search

7 December 1995

Date of mailing of the international search report

21.12.95

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2  
NL - 2280 HV Rijswijk  
Tel. (+ 31-70) 340-2040, Tx. 31 651 epo nl,  
Fax (+ 31-70) 340-3016

Authorized officer

V Beurden-Hopkins, S

# INTERNATIONAL SEARCH REPORT

information on patent family members

International Application No

PCT/US 95/09501

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP-A-0394954	31-10-90	US-A- 5108827 US-A- 5294482	28-04-92 15-03-94
EP-A-0273582	06-07-88	US-A- 4726989 AU-B- 590129 AU-B- 8058487 CA-A- 1318472 DE-A- 3785655 DE-T- 3785655 HK-A- 40194 JP-A- 63161035 SG-A- 42994	23-02-88 26-10-89 16-06-88 01-06-93 03-06-93 14-10-93 06-05-94 04-07-88 25-11-94
EP-A-0300689	25-01-89	US-A- 4833195 AU-B- 605888 AU-B- 1910688 JP-A- 1040546	23-05-89 24-01-91 27-01-89 10-02-89
EP-A-0619393	12-10-94	CA-A- 2120105 JP-A- 6313254	07-10-94 08-11-94